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mental character, and in some cases there are indications of violent explosive action. This is quite in accord with the andesitic nature of materials thrown out, which are of types common in the Pacific region. As to the age of the rocks, it would be idle to speak until the evidence of their organic contents has been duly set forth; but it would undoubtedly be very rash to refer them all to a recent age, and some of them may be found to go back far into the Tertiary times."

Geological News—General.—Several fossils collected by M. Griesbach while exploring the Central Himalayas closely resemble those found in the corresponding Alpine beds. In view of this fact, the Academy of Sciences of Vienna has decided, by an agreement with the Indian Government upon an exploration of the Central Himalayan region in order to compare its geology with that of the Eastern Alps. M. Diener, president of the Alpine Club of Vienna, will take charge of the expedition. (*Revue Scientifique,* April, 1892.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—One of the most valuable contributions to American petrography that has yet appeared is that volume of the Arkansas Geological Survey Report that treats of the eruptive rocks of the State. In it the late Dr. J. F. Williams[2] gives an excellent account of the little-known but very interesting eleolite and leucite rocks that occur as bosses and dykes in Pulaski, Saline, Hotsprings, Garland and Montgomery Counties. It would be well worth the while to give a full abstract of the author's careful investigation of these extremely rare rock-types, but space allows merely a reference to the mere outline of his work. Especial importance is attached to the study of the eleolite syenites at the present time, particularly where its plutonic and dyke forms occur together, since Rosenbusch has recently prophesied the existence of a group of dyke forms which he calls monchiquites, that will be found to occupy a position among the eleolite rocks corresponding to that held by the camptonites, among the plagioclase rocks. The age of the Arkansas eruptives is probably late Cretaceous. In Pulaski County they form the main mass of Fourche Mountain. The most abundant variety here is that locally known as 'blue granite.' It is a granitic porphyritic rock in which the phenocrysts are orthoclase, and the ground mass is a granular aggregate of cryptoperthite, arfvedsonite, diopside, biotite, eleolite and other accessory components. Arfvedsonite is the most prominent dark constituent, while eleolite among the lighter-colored components is scarcely more than an accessory. The rock thus resembles the augite-syenite, called laurvikite by Brögger[1], but it contains so much more hornblende that Williams decided to give it a new name, pulaskite. Analyses of the rock and its feldspar follow:

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Ann. Rep. Geol. Surv. of Ark. for 1890, vol. ii, 457 pp.

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	MnO	K_2O	Na_2O	H_2O	P_2O_5
Rock.	60.03	20.76	4.01	.75	2.62	.80	tr.	5.48	5.96	.59	.07
Felds.	66.95	17.87	.90		.52	.24		7.82	5.20	.30	

A second rock, occurring along the base of the mountain and a short way up its sides in the form of sheets, is known as 'gray granite.' Its structure is trachytic granular, with large twinned microline-perthites, eleolite, biotite, diopside and aegirine in large quantities. The eleolite frequently changes into analcite. The rock, though quite acid, as the analysis shows, is nevertheless an eleolite syenite, closely similar to laurdalite.[2]

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	H_2O
59.70	18.85	4.85	1.34	.68	5.97	6.29	1.88

In and around the mountain are small dykes, filled with 'brown granite,' miarolitic eleolite-syenite and quartz syenite. The brown granite is an eleolite-syenite containing orthoclase, diopside, eleolite and biotite, but no amphibole. In chemical composition it is quite like nordmarkite,[3] but mineralogically it is very different. The miarolitic rocks are panidiomorphically granular. In the eleolite-syenite there is a tendency of the eleolite toward idiomorphic forms when it is not in large quantity. In the quartz syenites the quartz tends toward idiomorphism. An analysis of one of these rocks gave:

SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	MgO	K_2O	Na_2O	H_2O
64.63	18.15	3.05	1.00	1.54	.50	4.79	5.80	1.08

Rocks, called by the author border rocks, presumably occurring on the peripheries of dykes and bosses of the eleolite-syenite, contain tabular phenocrysts of sanidine and also sodalite and eleolite in a fine-grained groundmass of eleolite, orthoclase and minute idiomorphic pyroxenes and amphiboles that sometimes shows a fluidal structure. Because of their porphyritic structure and their close relationship with the eleolite-syenite they are classed by the writer among the tinguaites.

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[1] Zeits. f. Kryst., xvi, p. 28.

[2] Ib. p. 33.

[3] Ib., xvi, p. 54.

The augitic rocks associated with the eleolite-syenites in this region are classed in Rosenbusch's new division of dyke rocks monchiquite. They are all dark in color, and all are characterized by the possession of phenocrysts of augite or of biotite. Those containing olivine are placed with monchiquite, while of the non-olivinitic varieties two new groups are formed; one, called fourchite, possesses phenocrysts of augite; in the other, ouachitite, biotite occurs in large quantity. In the former augite constitutes nearly 75% of the entire rock. Its ground mass is now crystalline, but its structure is thought to be the result of the devitrification of a glassy base. In the amphibole ouachitites the phenocrysts are biotite, hornblende and a few augites in a fine-grained but originally a glassy groundmass. Augite is still the most prominent bisilicate, but it now constitutes scarcely 20% of the rock mass. The groundmass is composed of minute hornblende and augite crystals, with much magnetite and small, highly refractive grains of what the author supposed to be sphene. The base contains many small, lath-shaped crystals of feldspar. In addition to these two members of the monchiquite group, there is probably a true monchiquite at the south end of Allis Mt., in the same district. This rock is remarkable for its great number of sphene grains and for the common occurrence in it of pseudomorphs of biotite after augite.

At a few places where the contact of the syenite with the surrounding shales may be studied, the latter are found to be much changed and to have developed in them small, irregularly bounded feldspars, a few flakes of biotite, grains of magnetite and plates of hematite.

The sequence of the eruptives is believed to be as follows: Eleolite-syenite and pulaskite (same magma), fourchite, pegmatite and miarolitic dykes.

In the Saline County region the rocks are not very different from those of Fourche Mt. The prevailing gray syenite is coarser in grain than that of Fourche Mt., and its orthoclase crystals (intergrown with albite) tend to become porphyritic. The eleolite is also sometimes in large crystals. A plagioclastic variety of the same rock is slightly more granitic than the orthoclase variety. The pyroxene is aegirite instead of diopside. Pulaskite is absent from this region, but in its place occurs a porphyritic syenite with large orthoclase crystals, crystals of arfvedsonite, biotite and an occasional diopside, imbedded in a fine-grained mosaic of orthoclase and amphibole. This rock also contains spheroidal masses of orthoclase crystals that may be pseudomorphs after leucite. The dyke rocks cutting the eleolite-syenite are grouped into eleolite-syenite pegmatites, aegirite tinguaites and eleolite porphyries. The tinguites are non-eleolitic, while the eleolite porphyries contain large rounded eleolites and aegirites enclosed in a fluidal mass of needles of the last-named mineral. The augitic dykes are much more common in this region than elsewhere. They belong to the monchiquites and the amphibole varieties of this rock. The ground mass of the latter consists of a transparent mass, partly isotropic and partly doubly refracting, in consequence of the development in it of plagioclase and orthoclase laths. Contact rocks are rare, but in one idiomorphic crystals of astrophyllite and aegirine were observed.

The Magnet Cove region is especially interesting, not only because of the fine minerals that occur there, but also because of the great variety of rare rocks found in the neighborhood in great quantity. It is to these latter that the minerals owe their origin. Of the eleolite-syenite occurring here three types are distinguished. One is an eleolite mica syenite, a coarse-grained rock in which eleolite has almost completely replaced orthoclase as the alkaline component. Eleolites, apatites, schorlomites and protovermiculites measuring as much as eight inches in diameter are frequently found imbedded in the decomposed rock. The principal constituents of the fresh rock are allotriomorphic eleolite, biotite crystals, idiomorphic zonal melanites, allotriomorphic schorlomites and large round masses of the same mineral, diopside, crystals of sphene, of ilmenite and of magnetite (the latter giving rise to the lodestone from which the Cove takes its name), pyrite and apatite in large crystals and in needles radiately grouped. Besides these there are also found in the decomposed rock ozarkite, protovermiculite, cancrinite and calcite. The second variety of the syenite is an eleolite garnet syenite made up of a granular mixture of eleolite, melanite and diopside, with small quantities of biotite and the usual accessories. The third type is a miarolitic variety too much weathered to yield good sections. Of the eleolitic dyke rocks one is hypidiomorphically granular, with a tendency to the trachytic structure. It contains a large quantity of orthoclase, eleolite in idiomorphic and allotriomorphic grains, large idiomorphic crystals of aegirine, cancrinite that appears to be in part primary, several other accessories and a number of secondary substances, among which may be mentioned aegirine, fluorite and calcite. A pegmatitic dyke consists of huge microline crystals, beautiful crystals of aegirine, eleolite, eudialite, and other decomposition products of eleolite. This rock is the gangue of many of the sphene, natrolite, brucite, manganopectolite and eucolite crystals obtained in this region. Other dykes in which eleolite occurs in two generations, sometimes with and sometimes without orthoclase in the ground mass, and an eleolite tinguite, in which the phenocrysts are orthoclase are also described. But perhaps the most interesting of the rocks of Magnet Cove are the leucite dyke rocks. Of these the author distinguisues between leucite-syenite and leucite-tinguaite. The former is a hypidiomorphic granular aggregate of a pseudomorph after leucite, eleolite, orthoclase and the basic silicates, diopside and biotite. It is generally connected with eleolite-syenite, and is easily recognized by the large crystals of pseudo-leucite scattered through it. These are imbedded in a ground mass in which may be detected eleolite, black garnets and feldspar. No trace of leucite may be discovered in the large crystals. They are now composed of tabular orthoclases, interspersed with small eleolites and pyroxenes. Within the mass the orthoclase is radial, while on its periphery small tabular crystals have their symmetry planes perpendicular to its surfaces. The ground mass has the structure of an eleolite porphyry. The tinguite occurring as dykes possesses two generations of orthoclase, aegirine, eleolite and the pseudomorphs of leucite, besides many accessory components. It differs from the eleolite-tinguite mainly in the possession of orthoclase in large quantity. Analyses of eleolite-tinguite, leucite-syenite, tinguite and of the pseudo-leucites follow:

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	SrO	MnO	MgO	K_2O	Na_2O	Cl	P_2O_5	Loss
Ele-Tin.........	53.76		23.21	1.27	3.18	2.94	.04		.23	7.01	6.97	.02	tr.	1.71
Leu.Sye......[1]	50.96	.52	19.67	7.76		4.38		tr.	.36	6.77	7.67			1.38
Leu-Tin......[2]	52.91		19.49	4.78	2.05	2.47	.09	.44	.29	7.88	7.13	.53	tr.	1.19
Pseudo-Leu..	55.06		25.26			.60	tr.		.28	10.34	7.60			1.78

On the contact of the eruptives with the country rock hornstones are formed, but these are so indefinite in their character that but little could be learned from their microscopic study. In the sandstones and limestones through which the eleolite-syenite cuts there are, however, important contact minerals, many of which are of world-wide interest. Among those found in quartz rock and sandstone may be mentioned smoky and milky quartz, arkansite, rutile and hematite. The limestone gave rise to perofskite, magnetite, apatite, phlogopite, vesuvianite and monticellite.

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[1] The leucite-syenite contains .54% of NaCl in addition to the sodium given above, besides a trace of SO_3, and the leucite-tinguaite[2] .52% of SO_3 and .48% of insoluble oxides.

In the potash Sulphur Springs region the eleolite and augite rocks are but little different from those of Magnet Cove. The shale in contact with one of the eleolite-syenite dykes, however, differs somewhat from the contact rocks of other regions. Close to the eruptive the shale has a glassy appearance, and is cut by sheets and masses of pink and white minerals and bands of coarse crystalline calcite. Under the microscope sections are seen to consist of plagioclase, wollastonite, apatite and pyroxene in small interlocking crystals. The white masses cutting it are wollastonite, while the pink ones are xonotlite (hydrated wollastonite), in which a tenth of the CaO has been replaced by Na_2O. The author calls the variety natroxontolite.

Outside of the regions above mentioned aegirite-tinguite dykes occur at Hot Springs and at Hominy Hill, in Sec. 27, T. 1 N. R. 14 W.

The basic dykes outside of the syenite areas have been studied by Kemp, whose report comprises the twelfth chapter of the book under review. Most of them are narrow. In composition they are so closely related to the rocks already mentioned in this abstract that they are regarded as genetically connected with them. The most interesting of the dyke masses are the ouachitites. These are dark in color, and are all porphyritic, with very large phenocrysts of biotite and augite. The groundmass in which these are imbedded is composed of augite, magnetite and glass. An analysis of one of these rocks yielded:

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O	CO_2	P_2O_5	Tot.
36.40	.42	12.94	8.27	4.59	14.46	11.44	3.01	.97	2.36	3.94	1.04	=99.84

This rock, which is so very basic, is a constant associate of the more acid eleolite-syenite. All the basic dykes that have thus far been discovered in the State are mentioned in a table containing 280 entries.

In conclusion the author recapitulates his classification as follows: The eleolite plutonic rocks are called eleolite-syenites. From these are sharply separated the dyke forms, mentioned under eleolite-syenite dyke rocks, which are not porphyritic, but in the variety pulaskite (hornblende eleolite-syenite) are trachytic; the eleolite porphyries, in which eleolite phenocrysts occur; and the tinguites, characterized by porphyritic crystals of orthoclase. Among the latter are the eleolite, leucite and aegirite varieties.

Miscellaneous.—New books, etc.—Mr. Lane[1] has recently published two tables for the use of students in optical mineralogy and petrography. One is devoted to the rock forming minerals. These are divided into three classes, the opaque, the isotropic and the anisotropic groups, and the members of the latter class are subdivided in accordance with the strength of their double refraction, their habit and the character of their extinction. There is no doubt but that with a little practice the student may easily learn to distinguish between the various minerals found in rocks if he will only follow the scheme carefully after reading the explanation accompanying it. In the second table the author gives an excellent resumé of Rosenbusch's classification of massive rocks, as elaborated in his 'Massige Gesteine.'——An even more recent tabulation of igneous rocks is that of Dr. Adams[2], since it reflects Rosenbusch's present attitude with respect to rock classification. In it the author represents in a very concise and simple form the differences between the various types of massive rocks, and suggests at a glance their relationships. In each of three horizontal columns are placed the plutonic, dyke and volcanic rocks in such a way that the corresponding members of all classes fall in vertical columns. The novel features of the classification are the following: Leucite-syenite is made a sub-group under the eleolite-syenites, and the tinguaites are represented as their corresponding granitic dyke forms. The rocks in which leucite, nepheline and melilite replace feldspar are given columns between the orthoclase and plagioclase rocks, as better indicating their chemical affinities than is the case when they are placed beyond the plagioclastic rocks. Each of the three groups is divided in accordance with the presence or absence of olivine, and in the niche for the plutonic nepheline combination is placed the new type iolite, recently described by Ramsay[3]. The lamprophyric dyke melilite rock is alnoite. Among the lamprophyric plagioclase nepheline rocks are fourchite and monchiquite, the latter with and the former without olivine. Malchite is a new rock described by Osann. It is the granitic dyke form of diorite. The diabases are put in the paleovolcanic class, which, by the way, is not sharply defined from the neovolcanic class. The basic non-feldspathic rocks are separated into the pyroxenites and the peridotites, which names sufficiently define themselves. Dr. Adams deserves the thanks of all petrographers for his enterprise in the preparation of this, the only modern classification of massive rocks published.——INSTRUMENTS.—Salomon[1] describes a simple piece of apparatus by means of which the density of a heavy liquid may be rapidly determined without the inconvenience of the use of a Mohr's balance. It consists essentially of a W-shaped graduated tube, whose manipulation depends upon the principle that the heights of the liquid columns in its two arms will vary with their differences in density. By the aid of the instrument the specific gravity of each mineral in a rock powder may be determined without once emptying it of its solution.——Four new microscopes for crystallographic and petrographical purposes have lately been introduced to the favor of investigators. The three[2] from the manufactory of Zeiss in Jena present no peculiar features. The fourth was made by Nachet to the order of Wyrouboff[3], especially for observations at high temperatures. The objective is below the object, and the nicol prism and the illuminating mirror are above it. The stage is fixed, while the microscope body revolves. Attempts to use converged light with this instrument have failed, because of the great heat to which the condensers are subjected.

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[1] Am. Geol., June, 1891, p. 341.

[2] Can. Rec. of Sci., Dec., 1891, p. 463.

[3] Cf. American Naturalist, 1892, p. 334. By mistake iolite occurs in the wrong column in the table.

[1] Neues. Jahrb. f. Min., etc., 1891, ii, p. 214.

[2] Czapski, Neues. Jahrb. f. Min., etc., B B. vii, p. 497.

[3] Bull. Soc. Franc., d. Min. xiv., 1891, p. 198.